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A Pilot Study to Screen Fall Risk in Adult Health Care Employees

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A PILOT STUDY TO SCREEN FALL RISK IN ADULT HEALTH CARE EMPLOYEES

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This Scholarly Project, submitted by Patricia Borboa, Emily Hansen, Jessica Hoeft, and Alicia Holzer in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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PERMISSION

Title	A Pilot Study to Screen Fall Risk In Adult Healthcare Employees
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ABSTRACT

Background and Purpose: Due to the increasing age of the working population, falls are becoming an escalating problem especially in the healthcare industry. The purpose of this research study is to develop a cost effective quick screen to determine fall risk in healthcare employees. Our overall goal is to take the results gained from this pilot study and apply them on a larger scale in hopes of preventing falls thus decreasing dollars spent by companies on work injury.

Subjects: Volunteers from a local Health Care System. Inclusion criteria: permanent employees, over the age of 20, without an assistive device. A total of 76 subjects were included in the sample, age range from 22 to 66 years of age.

Methods: Subjects were tested in four balance measures including: the five times sit to stand test (FTSST), single leg stance test (SLST), tandem walking, and the functional reach. Relationships of balance measures and fall history were performed using crosstabulations. Chi-square analysis and independent measures t-test were used with an alpha level of .05 for nominal data. Within the crosstabulations, the standardized residual was used to identify which cells contributed most to the significant chi-square and was set at $\geq |1.96|$.

Results: Pearson chi square tests of independence showed no significant relationships between the individual balance measures and subject's fall history. Medication use illustrated similar trends as in current literature, but was not statistically significant.

Discussion and Conclusion: The results of this study did not confirm any one balance measure that would be a good predictor of falls to include in a fall risk assessment in healthcare employees. Due to limited sample size, investigating a relationship between a combination of multiple tests and fall history was not feasible. However, due to the limitations of this study, and the amount of literature that is available confirming that many of these assessments predict fall risk, additional investigation is necessary. Although we did not achieve the desired results, further studies directed towards the development of a quick screen for fall risk in Healthcare employees are warranted in order to attempt to decrease falls in the workplace.

CHAPTER I

INTRODUCTION

Occupational related injuries are a common health problem in today's workforce. Approximately 3.8 million disabling injuries occur each year.[1] Workers compensation of North Dakota discovered that the health care industry, comprised of hospitals, clinics, and nursing homes, account for 11.8% of work related injuries giving it the highest incidence.[2] Due to these high incidence rates, employers are spending billions of dollars on medical related costs and lost wages. According to the National Center for Injury Prevention and Control, 15% of these injuries are due to slips, trips, or falls thus accounting for 12-15% of all workers compensation costs.[1] Falls are producing direct medical expenses of $179 million dollars for fatal and $19.3 billion dollars for nonfatal fall injuries in the year 2000.[1]

Slips and falls most frequently occur in the older population.[3] Falls are a risk factor for disease and frailty, therefore intensifying the disablement process in the older population.[1] In the United States, the fourth leading cause of fatal accidents and the primary cause of accidental death in the older population is falling.[4] It has been found that 30% of people over the age of 65 fall each year, and of those who fall, 20-30% suffer moderate to severe injuries.[5] According to Kemmert and Lundholm,

both male and female workers over the age of 45 had a significantly higher incidence of slips, trips, and falls, as well as longer periods of sick leave compared to their under 45 counterparts.[6]

Today we are an aging population. There are more than 70 million baby boomers in the workforce with one turning 50 years old every seven seconds, and the number of workers over the age of 55 is said to increase by approximately half from 1998 to 2008.[5] By the year 2015, it is predicted that people over the age of 45 will account for approximately 40% of the workforce, according to the US Bureau of Labor Statistics.[5] However, the largest jump in population growth is expected to occur once the baby boomer generation reaches the eligible retirement age of 65 between the years of 2010 and 2030, therefore causing fewer workers to be available. Potentially, this may lead to older workers remaining in the workforce longer than the normal retirement age.[5] Therefore, because of the increase in the number of the aging population still in the workplace, there is an increased risk of falls resulting in injury. Due to this fact, developing a screen for fall risk in the workplace could be a beneficial component for work injury management.

There are many assessments currently used for fall risk. Fall screens for community dwelling older adults and for older adults in various levels of assisted living and skilled care facilities are available in the literature. The Berg Balance Scale,[7] the Tinetti,[8] the timed up and go,[7] the five times sit to stand test,[6] functional reach,[9] and the Dynamic Gait

Index,[10] are just a few of the common tests used for assessments today. However, the literature is void of fall screens for older adults in the workplace.

The purpose of this research study is to develop a cost effective quick screen to determine fall risk in healthcare employees. Our overall goal is to take the results gained from this pilot study and apply them on a larger scale in hopes of preventing falls, thus decreasing dollars spent by employees and companies on work injury.

CHAPTER II

LITERATURE REVIEW

Why is this happening? There are many different explanations available in recent literature. It is well known that aging comes with many physiological changes that can impact performance at work. Vision, hearing, joint mobility, manual dexterity, balance, strength, reaction and movement times, and endurance are all known to decline with age.[5] A decline in strength[11] and postural control may lead to decreased balance, thus increasing one's susceptibility to falls.[12] Proprioception, motor strategies, and vestibular function are important components in the maintenance of balance. Proprioception is the body's orientation in the environment, which makes it essential for postural control, along with motor strategies.[13]

The motor strategies targeted in this study include the hip and ankle. Hip and ankle strategies are activated when it is necessary to lean forward or backward in order to shift the body's center of mass,[13] which commonly occurs while preventing the body from falling. The abdominals, paraspinals, quadriceps, anterior tibialis, hamstrings, and hip abductors are the key muscles used in these strategies.[13] Therefore, strength is very important in balance control, which is further validated in a study

performed by Maynard.[3] This study found that the two main reasons for increased fall risk with aging are reaction time and muscular strength. Maynard attributes the increased fall risk to the loss of strength in the muscles that we use to recover from a slip and the delayed reaction time that occurs when compared to youth.

In addition to assisting in postural control, the vestibular system aids in the stabilization of gaze during head movements and orientation of the head with reference to gravity. When the body is in motion or on uneven surfaces, our vestibular system plays a role in the maintenance of our balance.[13] Therefore, it is important to assess the vestibular system when identifying fall risk.

Furthermore, the literature also includes medication use as an indicator for increased fall risk. Within the older population living in the community, aged-care hostel, and nursing homes it has been shown that medications that cause sedation, orthostatic hypotension, or cognitive psychomotor impairment are risk factors for falls.[14] Anti-inflammatory drugs or NSAIDs are used widely by many individuals regardless of age and have also been implicated in increased fall risk.[14] Not only are there specific drugs that cause increased risk, but also it has been reported that if you are taking three, four or more medications regardless of type, your risk of falling increases.[15] Therefore, how many medications subjects were on was included in this study.

There are many fall screens available for both community dwelling and institutionalized individuals, but the literature is lacking in the area of working individuals. Since the literature is void of fall screens for older adults in the workforce, the authors researched the literature for four tests that have proven to be good measures of fall risk. Several fall assessments were researched in order to identify which four would be the best to target fall risk in working individuals over the age of 20.

The timed up and go (TUG) test is a commonly used assessment in both populations. According to Shumway-Cook et al [16] the timed up and go is a valid method for screening for both mobility and fall risk. However, the TUG has not been found to differentiate between fallers and non-fallers due to its low sensitivity.[7] In addition, the Tinetti is another commonly used assessment and it has been found to be a reliable test in community dwelling older adults. The Tinetti and TUG were found to be more suitable for frail elderly or those who use walking aids.[8] Therefore, these tests were not chosen for this study since they do produce as accurate results with our specific study population, which excludes assistive device use.

The Berg Balance Scale is another fall assessment commonly used. It has been found to have a high reliability and validity[17] in addition to good sensitivity and specificity for discriminating between fallers and non-fallers.[7] However, it is a 14-task assessment, which could potentially take up too much time. Therefore, it would not be an efficient test to be

used in a quick screen for workplace individuals. Two of its components, the single leg stance and forward reach tests, will be included and are discussed in the further paragraphs.

According to Shubert et al,[18] the role of static and dynamic components in the maintenance of balance is a key predictor of falls and function in older individuals. A brief assessment containing these items may determine whether or not there is a specific impairment.[19] In addition, proprioception, motor strategies, and vestibular function are all main factors in maintaining balance.[13] In order to include these components, as well as good discrimination between fallers and non-fallers, the four tests chosen were the five times sit to stand (FTSST),[20] functional reach,[9] tandem walking,[10] and one-legged stance tests.[8]

The transitional movement of going from sitting to and from standing is used often in everyday life and has been found to be a good predictor of function in the elderly. For more than two million non-institutionalized people over the age of 65, getting out of a chair or a bed is a challenge.[21] According to a study performed by Whitney et al,[20] the FTSST is proficient in recognizing people with balance disorders and is enhanced when used with individuals younger than the age of 60. Another study by Shenkman et al[19] reported that lower extremity strength and balance control both contribute to how well a person performs the chair rise, with strength being the strongest predictor. This further validates the

role of strength in fall risk. Therefore, the FTSST is an important test to incorporate into a fall screen.

In a study performed by Weiner et al, [9] the functional reach test was found to be both a reliable and clinically accessible balance tool, easy to perform, and contained both criterion and concurrent validity. Further, they found that the impairments, identified by the functional reach test, were less reflective of age and more of physical frailty. In addition, Duncan et al[12] found that functional reach is highly reproducible, inexpensive, and a good assessment of postural control. Functional reach has also been found to have a strong correlation with tandem walking.[9]

When assessing balance, gait performance has been identified as a gold standard.[22] Therefore, tandem walking was used as the gait assessment portion in this study. It was taken out of the Functional Gait Assessment (FGA), which is a modified version of the Dynamic Gait Index (DGI). The FGA contains three higher levels of gait components in order to avoid the ceiling effect of the original DGI. The DGI has been found to assist in discerning whether or not a person has a balance disorder with an 85% discriminative ability.[20] Neither literature nor normative data specifically pertaining to the tandem walk portion of the FGA are known. However, it has been found to be difficult to perform for people with vestibular disorders.[20] Through this study, the authors hope to obtain results that will further validate this component as a necessary aspect of a fall risk assessment.

Single leg stance test (SLST), also called one-legged stance test, is another commonly used assessment for fall risk. This study utilized eyes open and eyes closed under two test conditions: on a level surface and foam surface. The purpose of using the two different test conditions is to target vestibular disorders. Allum et al [22] reported that altering visual input through eyes closed on a level surface, as well as proprioceptive input by standing on foam, proved to be almost impossible for those with unilateral vestibular loss. Also, with a decreased SLST time, there is a decrease in quadriceps strength correlating with an increased fall risk, further validating the role of strength in balance.[22] In a study performed by Briggs et al,[23] mean balance time was found to significantly decrease with age. In addition, foot dominance was not found to affect balance performance.[23] The SLST has been reported to be a significant predictor for injurious falls. Vellas et al [24] discovered that people who could not stand on one leg for five seconds were 2.1 times more likely to sustain an injurious fall. Finally, the SLST was found to be a useful quick screening tool to identify fall risk in an outpatient health care facility.[25]

As noted above, physiologic changes, motor strategies, and vestibular function have been implicated in fall risk. Medication use, also being a fall risk indicator, is common to not only the older population, but younger generations as well. All of these factors play an important role in overall balance function and were taken into account in this study. The four components included in the balance assessment screen have been

shown to be effective in predicting fall risk. Therefore, it is predicted that these four tests will correlate with increased fall risk and may be included in a larger study to develop a quick screen for healthcare employees.

CHAPTER III

METHODS

The advisor of the following research was Dr. Beverly Johnson. Her doctoral work was with Workplace Safety and Insurance of North Dakota addressing the difference in work injury between older and younger workers. She has also worked on prevention and wellness programs with BCBS of North Dakota. The principle investigators are four senior graduate students enrolled in the Doctoral Physical Therapy program at the University of North Dakota and have been trained through class and instrumentation. Prior to initiating the project, two representatives from the research group and the project advisor attended a meeting held with Work Injury Management staff at Altru Hospital. Work injury report data was reviewed and the group concluded falls were a concern in this workplace. The purpose of this project was to perform a pilot study to identify which balance measures would be useful as a quick screen for fall risk in healthcare employees.

SUBJECTS

Subjects were recruited through fliers and the project advisor's assistance. Once research was initiated, further assistance was provided through support of an Occupational Medicine physician

employed at Altru Health Systems. Volunteer subjects were permanent employees, over the age of 20, who were employed at Altru Health Systems. Workers who required the use of any assistive device for ambulation were excluded from this study, as were students and volunteers. A total of 79 subjects were tested and three were removed due to improper footwear, volunteer status, and assistive device use. Therefore, a total of 76 subjects were included in our sample. Their age range was 20-66 years, including 13 males and 63 females. Job positions were broken down into four categories: 25 professional/patient care, 14 support staff/patient care, 28 office personnel, and 9 maintenance/security. Prior to participation, all subjects signed a consent form, which was approved by the Institutional Review Boards at the University of North Dakota and Altru Health Systems. A copy of the consent form was offered to all subjects who participated. (Appendix A)

PROCEDURE

All subjects were given a questionnaire (Appendix B) and brief interview regarding their fall history, medications, and general information such as age, gender, job position. The interview portion, given by one person, was used to help standardize and clarify information gained from the questionnaire. All subjects were provided with a specific definition of a fall to make clear what incidences should be considered. A fall was defined as any incidence when the body came into contact with the ground/surface or in the event the subject was required to grasp a hold of

something to prevent an eminent fall. Any subject with one or more falls within the last year was considered to be a faller and those with no falls reported were considered non-fallers. The researchers, four Physical Therapy students at the University of North Dakota, were completely blinded to this information. Prior to testing, inter- and intra-rater reliability were established using the following protocol (values included in further paragraphs). The subjects were tested in four different balance tasks/measures in which shoes were mandatory. These measures included the five times sit to stand test (FTSST), single leg stance test (SLST), tandem walking, and the functional reach. Each subject was randomly assigned to two researchers, each performing two of the four balance measures. Subjects were tested once on all four measures in random sequence.

The FTSST (intra- and inter-rater reliability 0.8832-0.9220 and 0.9898, respectively) was performed by instructing the subject to sit down, in a standard height chair of 43cm, placing their feet comfortably in front of them. The subject was then asked to cross their arms against their chest and to stand up and sit down five times as fast as possible when the researcher said the word go, making sure to come to a complete stand each time. The subject was able to start with their back against the chair, but was instructed to not touch their back against the chair in between repetitions of sit to stand. Timing for the FTSST began when the researcher said "go" and ended when the subject's buttocks touched the

chair on the fifth repetition. Scores were then compared to norms previously established in recent literature. A FTSST time of greater than 14.2 seconds in subjects over 60 years of age or a time of greater than 10 seconds in subjects less than 60 years of age may indicate balance impairment.[20]

In the single leg stance test (SLST), the subject was able to choose one leg in which they preferred to use throughout the duration of the test. This test included the ability to stand on one leg for thirty seconds or as long as they were able to in the following conditions: level surface with eyes open (intra- and inter-rater reliability of 0.9989-0.9997 and 0.9998, respectively), level surface with eyes closed (intra- and inter-rater reliability of 0.2935-0.3079 and 0.9996, respectively), foam surface with eyes open (intra- and inter-rater reliability of 0.8708-0.8753 and 0.9989, respectively), and foam surface with eyes closed (intra- and inter-rater reliability of 0.7505-0.7594 and 0.9941, respectively). Subjects were instructed to keep their arms at their side, not to touch any other surfaces for support, and not to touch their suspended leg on the ground or brace it against their stance leg. Timing for the SLST began when the subject's foot lifted off the floor/foam and ended when the subject came into contact with another surface for support or once thirty seconds was achieved.[23, 26] See Appendix C for normative values for SLST on level surface eyes open and closed. No normative values were identified in current literature for

SLST on a foam surface. Therefore, all data pertaining to SLST on a foam surface was omitted from this study.

For tandem walking, (intra- and inter-rater reliability of 0.9183-0.9184 and 0.9999, respectively) a 12-foot piece of tape was placed on the ground in a straight line. The subjects were instructed to cross their arms against their chest and walk heel to toe along the entire length of the tape. The number of steps the subject was able to complete before staggering, losing their balance, or stepping off the line was recorded. For this test different grades were given to indicate the amount of fall risk. A normal score indicating no impairment was given if the subject could complete 10 steps without staggering, mild impairment was 7-9 steps, moderate impairment was 4-7 steps, and severe impairment was less than 4 steps or could not perform without assistance.[10]

The functional reach test (intra- and inter-rater reliability of 0.8663-0.9384 and 0.9608, respectively) was performed by having the subject reach forward as far as they could without taking a step or lifting their heels off the ground. A ruler was placed horizontally at shoulder height along a wall and the subject was instructed to reach in a plane parallel to the ruler without coming into contact with it and/or the wall. During the functional reach assessment a measurement was taken at the end of the subject's third digit while the subject was standing erect and after they had reached their maximum distance. The distances between these two points were recorded. Three trials were documented and an

average of those trials became the subject's final score. If the subject could reach greater than 10 inches they were considered unlikely to fall, with a reach of 6-10 inches they were considered two times more likely to fall, a reach less than 6 inches was associated with four times more likely to fall, and unable to reach was eight times more likely to fall.[9]

STATISTICAL ANALYSIS

Data was analyzed using SPSS Version 11.0 for Windows. Descriptive statistics were utilized to illustrate the frequencies among all variables. Relationships of balance measures and fall history were performed using crosstabulations and chi-square analysis. The alpha level was set at .05 for all statistical tests. Due to the small sample size, when the data for tandem walking and number of prescription medications were analyzed in their original format there were 1 or more cells with frequencies less than five. Data for tandem walking was collapsed into two groups those not at risk and those at risk for falling. With significant crosstabulations, a standardized residual of $\geq|1.96|$ was used to identify which cells contributed most to the significant chi-square. A similar method was used for the crosstabulations of medication use, breaking down the groups into no medication use and medication use. A standardized residual of $\geq|1.96|$ was again used to determine which cells contributed mainly to the significant chi-square.

A regression was unable to be performed due to the limited sample size. It was anticipated that there would be a relationship between

individual balance measures and fall history. We also anticipated a positive correlation between the number of prescription medications and subjects' fall history.[15]

CHAPTER IV

RESULTS

For this study 76 subjects were included in the data set. A total of 25 individuals were identified to have a significant fall history through the questionnaire and brief interview process. The questionnaire provided to the subjects required them to identify the location of their falls, and some subjects with multiple falls replied with more than one location. The most frequent fall location was at home with 17 responses, 7 at work, and 4 in other locations unspecified. There were 13 out of 25 fallers who reported injury sustained due to a fall. Two subjects required medical attention and there was no missed work due to fall injury. However, four subjects required modification of work in order to compensate for their injury.

In our small sample size there was 76.6% of participants with vision problems and 32.5 % of those had multifocal lenses. The number of prescription medications was broken down into two categories: no medications and one or more medications. In our data set there were 40 subjects taking no medications and 36 taking 1 or more medications.

Independent measures t-tests were performed in order to look at the relationship between the balance measures and subjects' fall history.

No significant relationships were found between any measure and fall history. (See Table 1)

For each balance measure, frequency tables were compiled to display how many subjects out of each measure tested within or outside of the normal range as demonstrated in previous literature. Crosstabulations were performed between those scores on the fall measures compared to those who had stated they had fallen in the questionnaire and interview. To identify if each individual balance measure was significant in recognizing those subjects who had a history of falls, a crosstabulation of the test versus fallers and non-fallers was performed. Pearson chi square tests of independence showed no significant relationships between the balance measures and subjects' fall history: functional reach ($\chi^2(1,n=76)=0.07$, $p=0.791$), sit to stand($\chi^2(1,n=76)=0.062$, $p=0.804$), single leg stance eyes open($\chi^2(1,n=76)=0.974$, $p=0.324$)and closed($\chi^2(1,n=76)=1.45$, $p=0.229$), and tandem walking($\chi^2(1,n=76)=0.246$, $p=0.62$). (See Table 2)

In regards to our proposed hypothesis on fall history positively correlating with the number of prescription medications, our results showed similar trends. The relationship between number of medications and fall history was significant, p=0.012. However, there were no cells with a standardized residual $\geq|1.96|$. The trends seen in our data was that the number of subjects taking one or more medications experienced more falls than expected and those on no medications fell less than expected.

Balance Measures		n	M	SD	t	df	p
Functional Reach	Non-faller	51	13.4390	2.89911	1.841	74	.176
	Faller	25	12.1872	2.53103			
Single Leg Stance-Eyes Open	Non-faller	51	25.7814	8.95810	.398	74	.692
	Faller	25	24.8932	9.50853			
Single Leg Stance-EC	Non-faller	51	10.4747	10.7009	.253	74	.801
	Faller	25	9.8312	9.81235			
Sit To Stand	Non-faller	51	8.4275	2.24936	-.955	28.823*	.348
	Faller	25	9.4320	5.01984			
Tandem Walking	Non-faller	51	10.1961	4.47669	-.370	74	.712
	Faller	25	10.6	4.45346			

Table 1. Results of balance measures for fallers and non-fallers; Independent Measure t statistics, Means (M), Standard Deviations (SD). *Independent measures t-test assuming unequal variances

Balance Measure		No Fall History		Fall History					
		Observed	Expected	Observed	Expected	χ^2	df	n	p
Functional Reach	At Risk	7	7.4	4	3.6	0.07	1	76	0.791
	Not at risk	44	43.6	21	21.4				
Single Leg Stance Eyes Open	At Risk	11	12.8	8	6.3	0.974	1	76	0.324
	Not at risk	40	38.3	17	18.8				
Single Leg Stance Eyes Closed	At risk	34	36.2	20	17.8	1.45	1	76	0.229
	Not at risk	17	14.8	5	7.2				
Sit to Stand	At risk	9	9.4	5	4.6	0.062	1	76	0.804
	Not at risk	42	41.6	20	20.4				
Tandem Walking	At risk	36	36.9	19	18.1	0.246	1	76	0.62
	Not at risk	15	14.1	6	6.9				

Table 2. Frequencies and chi square results for the relationship between risk of falling and fall history.

This was determined through a Pearson chi square test of independence showing $\chi^2(1, N=76)=6.361$, $p=0.012$. (See Table 3)

		No Fall History	Fall History	χ^2	df	n	p
No Medications	Count	32	8	6.361	1	76	0.012
	Expected Count	26.8	13.2				
One or More Medications	Count	19	17				
	Expected Count	24.2	11.8				

Table 3. Frequencies and chi square results for the relationship between medication use and fall history.

CHAPTER V

DISCUSSION

As stated above, the purpose of this research study is to develop a cost effective quick screen to determine fall risk in healthcare employees. The fall assessments tested were functional reach, SLST, tandem walking, and FTSST. No one assessment was found to be a significant predictor of fall history. In addition, medications were not shown to significantly correlate with an increased fall history. However, a trend of those who are on no medications had a history of less falls than expected and those taking one or more medications had a history of more falls than expected. Although our results are in contrast to much of the current literature that is available, there are some conflicting studies found which support our findings.

There is an abundance of literature available on functional reach and it's predictive value of falls. According to Weiner, Duncan, Chandler, and Studenski [9] if a subject shows a functional reach of less than seven inches, the subject would not be able to be independent in the community. Further, they found that the impairments, identified by the functional reach test, were less reflective of age and more of physical frailty. However, Lin et al [8], found that functional reach showed a poor response to falls.

Thomas and Lane [25] also support this finding. They found that the functional reach test did not differentiate between fallers and non-fallers. Valid and reliable studies with larger sample sizes need to be performed to determine whether or not this test is predictive of fall risk.

Vellas et al [24] stated that the SLST is a statistically significant predictor of injurious falls, but not of fall risk. Lin et al [8] found that SLST was suitable for healthy older people, which narrow the scope of the subject population tested. On the other hand, Allum et al [22] found that with a decreased SLST time, there is a decrease in quadriceps strength correlating with an increased fall risk. It is also able to show unilateral vestibular loss when performed with the eyes closed. SLST was also determined to be a useful quick screening tool to identify fall risk in an outpatient health care facility.[25]

Although the DGI has been found to assist in discerning whether or not a person has a balance disorder with an 85% discriminative ability, tandem walking has not distinctively been identified as a fall predictor. Literature and normative data specifically pertaining to the tandem walk portion of the FGA are unknown. However, it has been found to be difficult to perform for people with vestibular disorders.[20] It was the hope of the authors to obtain results that would have further validated this component as a necessary aspect of a fall risk assessment. Unfortunately, the results did not correlate with a subjects fall history.

The FTSST test has been found to differentiate between people with and without balance problems, regardless of age.[20] According to Schenkman, Hughes, Samsa, and Sudenski,[19] strength correlates highly with dynamic balance control. This is in contrast to the findings of this study. However, there were limitations that may have been strong contributors to these results.

As stated above, the results from our study did not reach a level of significance to demonstrate that increased medication use correlated with fall history. It has been reported in the literature that if you are taking three, four or more medications regardless of type, your risk of falling increases.[15] However, in this study only 16% of those with a significant fall history and less than 7% without a fall history were on four or more medications. Therefore, although there was a trend seen of those on medications having a significant fall history, our sample size was too small to relate it to the literature. However, it has been noted that specific medications cause more of a risk for falling. According to Leipzig, Cumming, Tinetti[15] within the older population living in the community, aged-care hostel, and nursing homes, medications that cause sedation, orthostatic hypotension, or cognitive psychomotor impairment are risk factors for falls.[14] In addition, they found that NSAIDs can increase fall risk as well.[14] Therefore, future studies should find out what type of medications people are taking verses just the amount.

LIMITATIONS AND STRENGTHS

There were many limitations to this study. First, we had a subject population of 76 people with 25 fallers and 51 non-fallers. A larger subject size and more equal groups may have changed the outcome of this study. The questionnaire asked the subject to report how many times they have fallen in the past month, 3 months, 6 months, and year. The results of this question may have been confounded by subjects not being able to remember when they fell, or not wanting to disclose the fact that they have fallen. Therefore, whether or not people were true non-fallers is unknown. The same dilemma may have occurred with the reporting of medication use. It also was not specified to state the exact medications that they were on, as in the literature it is known that certain medications affect balance more than others. People may not consider NSAID's to be a medication and this is known to increase fall risk.[14] Plus, the small sample size used in this study did not enable us to relate the results to current literature.

In addition, the FTSST performance was variable between individuals. Some people did not perform it as fast as they could, or they used momentum to get up. The results from this test may have been different if we would have standardized it more so each person performed it in the same manner.

In contrast, one of the main strengths of this study was the inter-rater and intra-rater reliability. The exact statistics were stated previously in the methods section of this study. Having good inter-rater and intra-rater

reliability is extremely important in order to ensure accuracy in testing. It is necessary for there to be stability, not only when different testers are administering the assessments, but also when the same tester administers an assessment repeatedly under identical conditions. Another strength was that we were blinded to who were fallers and non-fallers so as not to contaminate the results.

FUTURE STUDIES

The overall goals of this study were to take the results gained and apply them on a larger scale in hopes of preventing falls, thus decreasing dollars spent by employees and companies on work injury. Because the results did not turn out to be statistically significant, further studies are warranted. These studies need to have larger sample sizes, and possibly be more of a longitudinal study where the subjects are tracked over time to see how many times they actually fell to standardize which subjects are fallers vs. non-fallers. It would be beneficial to find out exact medication use, including both prescriptions and over the counter drugs. This could be accomplished by having the subjects bring in a list of current medications including over the counter medications.

A larger sample size would also allow for a regression analysis to determine if a combination of the balance measures would identify fallers from non-fallers. This topic of study is very important for this day in age. Falls in the workplace are costing employers and employees large amounts of money.[1] Since we are an aging population, falls in the

workplace are only going to increase, thus affirming the need for further studies.

CHAPTER VI

CONCLUSION

The results of this study did not confirm any one balance measure that would be a good predictor of falls to include in a fall risk assessment in healthcare employees. Due to limited sample size, investigating a relationship between a combination of multiple tests and fall history was not feasible.

However, due to the limitations of this study, and the amount of literature that is available confirming that many of these assessments predict fall risk, additional investigation is necessary. Although we did not achieve the desired results, further studies directed towards the development of a quick screen for fall risk in Healthcare employees are warranted in order to attempt to decrease falls in the workplace.

APPENDIX A

INFORMED CONSENT

TITLE:	*A Pilot Study to Screen for Fall Risk in Health Care Employees*
PROJECT DIRECTOR:	**Dr. Beverly Johnson**
PHONE #	*(701)777-3871*
DEPARTMENT:	*Physical Therapy*

STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on an understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research pilot study about developing a Screen for Fall Risk In Healthcare Employees because you are a permanent employees working in a health care setting.

The purpose of this research study is to develop a cost effective quick screen to determine fall risk in healthcare employees. Our overall goal is to take the results gained from this pilot study and apply them on a larger scale in hopes of preventing falls thus decreasing dollars spent by companies on work injury and pain and suffering experienced by the injured employee.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 80+ people will take part in this study at the University of North Dakota. Subjects will be recruited from Altru Hospital and their satellite clinics.

HOW LONG WILL I BE IN THIS STUDY?

Your participation in the study will last no longer than 35 minutes for one visit. You will need to come to Altru at the designated times listed on the flier.

WHAT WILL HAPPEN DURING THIS STUDY?

You will be interviewed on the questionnaire you received and then will proceed to four stations where your fall risk will be assessed. The tests consist of movement, reaching, and balance activities.

WHAT ARE THE RISKS OF THE STUDY?

There may be some risk from being in this study such as fatigue or falling, however this risk is minimal and you may stop at any time throughout the process. A tester will be close by to minimize any risk of falling. You may experience some frustration that is often experienced when attempting a task that is difficult. Some questions may be of a sensitive nature, and you may therefore become upset as a result. However, such risks are not viewed as being in excess of "minimal risk"

WHAT ARE THE BENEFITS OF THIS STUDY?

Personally, this study can have some great benefits for you. Learning about your fall risk to help prevent any future injury. We also hope that, in the future, other people might benefit from this study because the results gained from this study will hopefully be applied on a larger scale in hopes of preventing falls thus decreasing dollars spent by companies on work injury and decreasing the likelihood of cost and pain to injured workers.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

You will not have any costs for being in this research study.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study. However, if you are found to be at risk for falls, you will be invited to attend an education seminar on falls and be given a personalized intervention program.

WHO IS FUNDING THE STUDY?

The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research study.

CONFIDENTIALITY

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies, the UND Research Development and Compliance office, and the University of North Dakota Institutional Review Board

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained, and there will be no social security numbers obtained. If names are given, numbers will be associated with the names for our study.

If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified.

COMPENSATION FOR INJURY

In the event that this research activity results in an injury, treatment will be available including first aid, emergency treatment and follow-up care as needed. Payment for any such treatment is to be provided by you (you will be billed) or your third-party payer, if any (such as health insurance, Medicare, etc.) No funds have been set aside to compensate you in the event of injury. Also, the study staff cannot be responsible if you knowingly and willingly disregard the directions they give you.

IS THIS STUDY VOLUNTARY?

Your participation is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota.

If you decide to leave the study early, we ask that you please contact the researchers conducting the study.

You will be informed by the research investigator***[s]*** of this study of any significant new findings that develop during the study, which may influence your willingness to continue to participate in the study.

CONTACTS AND QUESTIONS?

The researchers conducting this study are: *Advisor Beverly Johnson and students Jessica Hoeft, Emily Hansen, Alicia Holzer, and Tricia Borboa.* You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact *Jessica Hoeft, Emily Hansen, Alicia Holzer, or Tricia Borboa* at *218-791-1474 or 310-924-9725* during the day and after hours. You can also contact our advisor *Beverly Johnson* at *701-777-3871.*

If you have questions regarding your rights as a research subject, or if you have any concerns or complaints about the research, you may contact the University of North Dakota Institutional Review Board at (701) 777-4279. Please call this number if you cannot reach research staff, or you wish to talk with someone else.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subjects Name: _____

Signature of Subject	Date

APPENDIX B

Fall Questionnaire: PID#_____ Date:_____

1. Age_____ Gender _____ Job Position _____

2. How many times have you fallen in the past
   - ____Year
   - ____6 months
   - ____3 months
   - ____Month
   - ____Week

3. Where did you fall? Be Specific (check all that apply)
   - ____Home
   - ____Work
   - ____Other (please specify, ie Walmart, parking lot, etc.)

4. What caused you to fall? (check all that apply)
   - ____Slippery surface
   - ____Loss of balance
   - ____In a hurry
   - ____Tripped up a curb
   - ____Other (please specify)

5. Did you sustain an injury due to the fall?
   - Type of injury
   - Body Part Affected

6. Did you seek medical attention?

7. Have you ever missed work due to an injury sustained from a fall, if so, for how long?

8. Did the injury cause you to modify your work habits? If so, how?

9. How many prescription medications you are currently taking?

10. Do you have any vision problems or wear glasses? ___Yes ___No
    If yes, Do you wear bifocals or trifocals? ___Yes ___No

11. In your opinion, what is the most common cause of falls in the workplace?

APPENDIX C

Normative Values for SLST on a Level Surface

Age	Eyes Open	Eyes Closed
20-29	30	28.8 +/- 2.3
30-39	30	27.8 +/- 5.0
40-49	29.7 +/- 1.3	24.2 +/- 8.4
50-59	29.4 +/- 2.9	21.0 +/- 9.5
60-69	22.5 +/- 8.6	10.2 +/- 8.6
70-79	14.2 +/- 9.3	4.3 +/- 3.0

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